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The cereal leaf beetle in Iowa oats: Research and education program for biological control and sustainable management practices

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Abstract: *The cereal leaf beetle,* (Oulema melanopusj, *a serious insect pest of small grains, including oats, was detected in the eastern half of Iowa in the early 1990s. Iowa's five leading counties for oat production are located in northeastern Iowa, and field surveys were conducted in this area to document the levels of cereal leaf beetle infestations, potential impact on production, and the presence of natural enemies. Findings showed that current cereal leaf beetle numbers are too low to cause economic damage and no compelling need exists to establish a management program aimed against this particular pest*

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Budget
$10,000 for year one
$10,000 for year two
$8,000 for year three

Background

The cereal leaf beetle, *(Oulema melanopus),* an exotic pest species believed to have arrived in North America in the late 1940s, was first detected in Iowa in the early 1990s. The cereal leaf beetle (CLB) can be a significant pest of small grains, and economically damaging levels of infestation were found in Michigan and Indiana in the early 1960s. Populations in these two states were successfully reduced by the introduction of several natural enemies from Europe. Additional efforts that were focused on breeding plant varieties with resistance to the pest met with limited success in grains other than wheat.

Oat producers in Iowa faced with this potentially deadly new insect pest would typically attempt to suppress it by using an insecticide. In Michigan and Indiana, following initial attempts to quarantine and eradicate CLB, a concerted biological control effort introduced several parasitoids from Europe aiming at curbing the pest. These parasitoids were distributed throughout the CLB-infested areas of the Midwest and Canada through "biological control days." On these days, Extension personnel and farmers arrived in Michigan to collect parasitized CLB larvae and then released them in their own states or on their own farms.

Biological control measures against the cereal leaf beetle have proved successful. Populations in Michigan have declined since 1971. Parasitism of CLB by the larval parasite *{Tetrastichus julis)* was over 65 percent and CLB damage to oats was rare. However, reductions in CLB populations may be due to a combination of factors, such as weather-related mortality, genetic alterations in the CLB population, and changes in over wintering habitats, along with the deaths from introduced parasites.

Cereal leaf beetles have recently broadened their territory into several Western states, including Utah and Montana. The beetles have also appeared in Missouri and eastern Iowa. The pests were first discovered in 1987 in four northeastern counties—Winneshiek, Allamakee, Fayette, and Clayton. The heaviest concentration of oats production occurs in this part of the state; 146,000 acres of oats were planted in the northeast section of Iowa in 1996.

The only parasitoid species recovered from collections of CLB eggs and larvae in Iowa and Missouri was *T. julis.* Allamakee and Fayette counties were the only two areas surveyed for parasitoids, hence the presence of parasitoids of the CLB in Iowa is not fully known.

Objectives of this study were to:

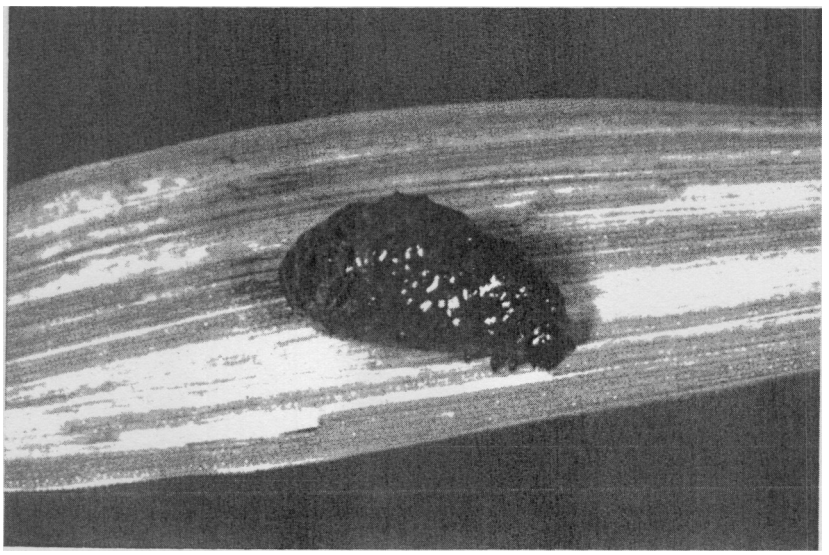
1) conduct field surveys in northeast Iowa to document levels of CLB infestations,
2) gauge potential impact on producers,
3) determine presence of any natural enemies (parasitoids).

Approach and methods

In 1993 and 1994, field surveys for the CLB were conducted in eastern and northeastern Iowa where much of the state's oat production is centered. Twelve to 16 fields were checked on a weekly basis from late May to late June or early July. Collection sites were located along an approximately north-south axis from Allamakee County to Cedar County. The fields selected for the study bordered wooded areas which serve as overwintering habitats for the CLB. Within each field, 500 sweeps were taken for four weeks in 1993 and five weeks in 1994. Sweep nets were carefully examined for cereal leaf beetle larvae which tend to remain stuck to the insides of the nets. The CLB larvae and other contents of the sweep samples were first placed in a plastic bag, then in a chilled cooler, and returned to the laboratory where they were examined for the presence of CLB larvae and adults. Beneficial insects (adults and immatures) that were counted included lady beetles, lacewings, minute pirate bugs, and hoverflies. When several CLB larvae were found in the sweep nets, attempts were made to collect up to 20 CLB larvae on oat leaves. These specimens were placed in plastic bags, chilled in a separate cooler, and taken to the laboratory where they were reared until parasitoids emerged or adult cereal leaf beetles hatched.

A similar but more restricted sampling program was followed in 1995. Due to the lack of cereal leaf beetles in eastern Iowa counties in 1993 and 1994, collecting sites were concentrated in northeast Iowa in Clayton and Dubuque counties. Sampling procedures were the same as 1993 and 1994.

The cereal leaf beetle was first detected In Iowa in the early 1990s.



Results and discussion

1993: Due to the wet weather, oat planting and growth were significantly delayed. Weekly samples were taken from 15 oat fields along a north-south axis from Allamakee County to Jackson County from early June to mid-July. But only 15 CLB larvae and adults were collected from these oat fields. It was concluded that the delayed planting schedule of oats, excessive rainfall, and lower than average temperatures were responsible for the low numbers of CLB recovered. The number of insect predators was highest in late June and early July.

7994: Weekly samples were collected from 15 oat fields along a north-south axis from Allamakee County to Jackson County from late May to late June 1994. On each sampling date, 500 sweep samples were taken per field. Compared to 1993, planting conditions in 1994 were near optimal for oats. Cereal leaf beetle larvae were collected at three sites in Clayton County on June 3, 1994. These larvae were gathered, returned to the laboratory, and reared for parasitoids. On June 10, CLB larvae were collected from six locations, five in Clayton County and one in Jones County; these individuals were also sent to the laboratory and reared. One CLB larvae was collected from one site in Jones County on June 17. A total of 19 CLB larvae were accumulated from the 1994 sample taking. No adult cereal leaf beetles were found in 1994. Four of the CLB larvae were parasitized by the larval parasitoid *T. julis*. The number of lady beetle predators (adults and larvae) collected from the 15 principal sites increased dramatically in 1994; numbers increased from approximately four per field in late May to 114 per field in mid-June.

The major difficulty in this study has been the low numbers of cereal leaf beetles found. Sampling efforts in Jones County over two

years resulted in the collection of only one CLB larva. Populations were higher in 1994 than in 1993, however they were extremely low relative to densities that can cause yield losses.

1995: Sampling this year was concentrated in two northeast Iowa counties—Clayton and Dubuque. Researchers collected 26 CLB larvae and four adults from eight to ten oat fields in these two counties during the period from June 5 to June 28. No parasitoids were raised from these CLB larvae. Densities of beneficial insect predators were highest on June 28, the last sampling date.

Conclusions

When we proposed this study in 1992, it was known that the cereal leaf beetle, a potentially damaging insect pest, was in Iowa, but there was no scientific basis to answer the following questions concerning the dynamics of CLB in Iowa's oat-growing regions in the eastern and northeastern portions of the state. Are the cereal leaf beetle populations increasing? Are they approaching densities that are known to cause yield losses?

Based on these samples from several oat fields over three years, the study concluded that the cereal leaf beetle is not increasing in numbers in eastern and northeastern Iowa. The CLB occurs in numbers far below the threshold that would cause economic losses to farmers.

Implications

This finding of very low densities of cereal leaf beetles is good news for oat growers in the eastern and northeastern sections of Iowa. The cereal leaf beetle, which was recently detected in the state, is not increasing in numbers. After three years of surveys, it was clear that the population of cereal leaf beetles is far below that which would cause any significant financial losses to oat growers. Currently, no need exists for a major extension effort for a pest management program on the cereal leaf beetle. We believe that drawing the attention of oat producers to the non-pest level densities of the CLB in their fields would be counter-productive.

Education and outreach

Marlin Rice shared information from this project with oat growers and extension specialists in northeast Iowa at grower meetings in 1995 and 1996.

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